

narrowed significantly, and there is very little noise in the frequency estimate.

FIG. 12B shows the phase correction (in degrees) provided by the output of the lead filter 142 as a function of time (in seconds). This correction varies widely until initial lock-on of the PLL 10 at 0.01 seconds. Since the bandwidth is still wide at this point, the correction varies. As the bandwidth is narrowed, the variation in the correction is reduced. At 0.02 seconds, the bandwidth has narrowed significantly and the variation is minimized.

FIG. 12C shows the bandwidth control signal (in Radians²) as a function of time (in seconds), which is a measure of the variance of the phase error. After initial lock-on of the PLL 10, the variance begins to decrease which, in turn, causes the dynamic bandwidth to narrow (see FIG. 12D). The variance continues to decrease as the PLL 10 improves its ability to estimate phase correction.

FIG. 12D shows the dynamic bandwidth (in Hertz) as a function of time (in seconds). The bandwidth is near its maximum of 1000 Hz up until initial lock-on of the PLL 10 at around 0.01 seconds. With lock-on, phase error is reduced, causing the bandwidth to begin narrowing. The bandwidth approaches its minimum of 100 Hz as the phase error continues to be reduced.

The process for determining the amount of phase error, determining an appropriate PLL 10 bandwidth, adjusting the PLL 10 bandwidth and controlling the VCO 118 to provide an updated correction signal 50 is summarized in FIG. 13. After the pilot signal 17 has been received (step 200) by the pilot rake receiver 40, the pilot signal 17 is despread (step 200) and corrected for channel distortion due to multipath reflections (step 204). A complex error signal is produced (step 206) and the error signal is normalized (step 208) prior to quantizing the phase of the error signal (step 210). The bandwidth control section 120 estimates the variance of the phase error (step 214) and determines the desired PLL bandwidth to produce a correction signal (step 216). The PLL filter 116 provides an estimate of the offset of the RF carrier signal and the phase error due to the carrier signal offset (step 212) and provides a correction signal (step 218) to the pilot rake receiver 40 and the data receiver 42. In this manner, the bandwidth of the PLL filter 116 is continuously adjusted and refined as the magnitude of the error signal 126 output from the arctangent analyzer 114 decreases.

Although the invention has been described in part by making detailed reference to certain specific embodiments, such detail is intended to be instructive rather than restrictive. It will be appreciated by those skilled in the art that many variations may be made in the structure and mode of operation without departing from the spirit and scope of the invention as disclosed in the teachings herein. For example, the specific transfer function may be modified depending upon the RF channel to be analyzed and the current conditions of the system. Additionally, analysis of the quantized phase error signal may be performed using a different mathematical analysis while still providing a continuously updated PLL bandwidth signal. The analysis to be performed on the quantized phase error signal is typically a trade off between the amount of processing power required for the computational analysis versus the improvement in performance.

What is claimed is:

1. A terrestrial RF communication system for receiving CDMA communication signals comprising:

means for receiving a CDMA communication signal transmitted on a selected RF carrier frequency, including means for removing said RF carrier frequency to provide a received information signal;

means for correcting phase errors of said received information signal including:

means for generating a local correction signal;

means for mixing said local correction signal with said received information signal to produce a phase corrected information signal;

means for analyzing the phase of said phase corrected information signal and generating a phase error signal based on the deviation of the analyzed phase from a predetermined phase of zero; and

means for adjusting the phase of said local corrected information signal continuously and recursively such that said phase is equal to said predetermined phase; said adjusting means including:

means for selecting a bandwidth with an adjustable range based on said phase corrected information signal;

means for estimating an offset by interrogating said phase error signal; and

means for modifying said local correction signal by said offset.

2. The system of claim 1 wherein said phase corrected information signal comprises an in-phase component and a quadrature component and said analyzing means further comprises look-up table means for determining the phase of said phase corrected information signal; wherein said look-up table means accepts said phase corrected information signal and outputs said phase error signal.

3. The system of claim 2 wherein said analyzing means further comprises normalizing means which includes:

means for determining the magnitude of the in-phase component and the magnitude of the quadrature-phase component;

means for determining the larger of said magnitudes; and means for dividing both said magnitudes by said larger magnitude to output a pseudonormalized phase corrected information signal.

4. The system of claim 2 wherein said selecting means further includes bandwidth calculation means which accepts said phase corrected information signal and outputs a bandwidth signal based upon a preselected transfer function.

5. The system of claim 4 wherein said estimating means further includes a filter, having a selectable bandwidth, for maintaining said adjusting signal within said selected range.

6. The system of claim 5 wherein said filter is responsive to said bandwidth signal from said bandwidth calculation means.

7. The system of claim 3 wherein said selecting means further includes bandwidth calculation means which accepts said pseudonormalized phase corrected information signal and outputs a bandwidth signal based upon a preselected transfer function.

8. The system of claim 6 wherein said estimating means further includes a voltage controlled oscillator, responsive to said filter means, for generating said adjusting signal.

9. The system of claim 8 wherein said transfer function comprises a continuous linear function.

10. The system of claim 2 wherein said look-up table means comprises a matrix of eight discrete in-phase component values by eight discrete quadrature component values.

11. The system of claim 2 wherein said analyzing means further comprises normalizing means which includes:

means for determining the magnitude of the phase corrected information signal; and

means for dividing said phase corrected information signal by said magnitude to output a normalized phase corrected information signal.